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(54) Orthopaedic apparatus, particularly for the surgical correction of bone deformations

(57) An orthopaedic apparatus, particularly for the surgical correction of angular and longitudinal defects of the bones of limbs, of the femur and tibia type, comprising a longitudinal rod (2) externally positionable substantially parallel to a bone for correction, a first clamp (3) movably anchored to the rod (2) for supporting drilling guides for screws insertable in a proximal portion of the bone, and at least one second clamp (4) movably anchored to the rod for supporting drilling guides for screws insertable in a distal portion of the bone. The first and second clamps are orientatable and selectively blockable, before the surgical intervention, in predetermined angular positions with respect to the rod (2) corresponding to the angular deformations of the bone, and are repositionable with respect to the rod in correct angular positions after the osteosynthesis of the proximal and distal portions of the bone so as to eliminate the angular deformations of the bone.

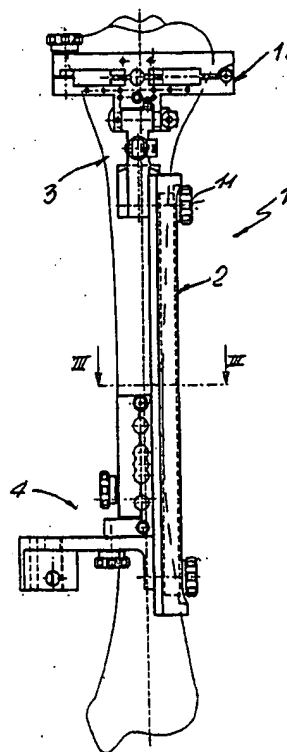


Fig. 1

## Description

### Technical Field

The present invention relates to an orthopaedic apparatus, particularly for the surgical correction of bone deformations, for example of the tibia and of the femur.

### Background Art

It is known that adjustable external fixation devices are commonly utilised for correcting certain angular and longitudinal deformations of long bones. Such devices essentially comprise groups of bone screws fixed in the bone portions affected by angular defects and held by clamps which are in turn slidably mounted on longitudinal guides externally positionable at the limb to be reconstructed.

The correction normally is carried out gradually with the aid of compressor-distractor devices which act on the mobile clamps while the bone callous regenerates itself allowing a certain degree of deformation.

This methodology, however much effective, requires correction times which are rather long and does not give any immediate result for the patient.

### Disclosure of the Invention

The present invention in accordance with one preferred aspect proposes to carry out an integral and immediate correction in the operating room of the defects obtained preliminarily by the surgeon by means of normal radiological procedures.

With this principal aim in mind, there is provided an orthopaedic apparatus, particularly for the surgical correction of angular and longitudinal defects of the bones of limbs, of the femur and tibia type, which comprises a longitudinal rod externally positionable substantially parallel to a bone for correction, a first clamp movably anchored to said rod for supporting drilling guides for screws insertable in a proximal portion of the bone, and at least one second clamp movably anchored to said rod for supporting drilling guides for screws insertable in a distal portion of the bone, said first and second clamps being orientatable and selectively blockable, before the surgical intervention, in predetermined angular positions with respect to said longitudinal rod corresponding to the angular deformations of the bone, and being repositionable with respect to said rod in correct angular positions after the osteosynthesis of the proximal and distal portions of the bone so as to eliminate the angular deformations of the bone.

### Brief Description of Drawings

The characteristics and advantages of the invention will become apparent from the description of some pre-

ferred but not exclusive embodiments of the apparatus according to the invention, illustrated for illustrative and non-limiting purposes with the help of the attached drawing sheets in which:

Fig. 1 illustrates a general front elevation view of the orthopaedic apparatus according to one preferred aspect of the invention applied to a bone to be corrected;

Fig. 2 illustrates a enlarged scale detail of the apparatus of Fig. 1;

Fig. 3 illustrates a top plan view of the detail of Fig. 2;

Fig. 4 illustrates a sectional view of Fig. 1 taken according to the plane III-III and shows another enlarged scale detail of the apparatus of Fig. 1;

Fig. 5 illustrates a bottom view of the detail of Fig. 4.

### Best Modes for Carrying Out the Invention

With reference to the cited figures, an orthopaedic apparatus for use in an operating room according to one preferred aspect of the invention, indicated globally by the reference numeral 1, comprises essentially a longitudinal rod 2 upon which a first end clamp 3 and a second end clamp 4, for supporting drill guides for bone screws (not shown in the drawings), are movably mounted.

The rod 2 defines a longitudinal axis Y, and has a semicircular transverse cross-section and a flat face 5 with a central longitudinal groove 6 and an elongated hole 7 which extend for nearly the entire length of the rod.

Preferably, the longitudinal groove 6 has a trapezoidal shape with the smaller side towards the flat face 5.

The first clamp 3 is substantially T-shaped with a portion 8 for connection to the rod 2 provided on its opposed faces with dovetail tenons 9, 10 counter-shaped with respect to the longitudinal groove 6. The clamp 3 is anchored to the rod by means of one of its tenons 9, 10 inserted in the groove 6, in proximity to one of its longitudinal ends, and is blocked thereat by means of a screw with a knob 11.

A supporting portion 12, for drilling guides of the bone screws insertable in the proximal portion of the bone, is united to the connecting portion 8, and is in turn formed by a substantially flat base plate 13 with two recesses 14 upon which a cover 16 also provided with recesses 17 is hinged at 15. The cover 16 is blocked against the base by means of a screw with a knob 18 so as to lock the drilling guides for the screws, with variable inclinations, between the recesses 14, 17.

The portion 12 is united to the portion 8 of the clamp 3 by means of an intermediate element 19 which has a first hinge axis A and a second hinge axis B, substantially perpendicular with respect to one another and with respect to the axis Y when the clamp 3 is anchored to the rod 2. In order to selectively block the angular

position of the intermediate element 19 with respect to the connecting portion 8 about the axis B there is provided a first eccentric stop 20 with a hexagonal set head. In order to selectively block the angular position of the intermediate element 19 with respect to the supporting portion 12 about the axis A there is provided a second eccentric stop 20' also having a hexagonal set head.

In order to maintain the two axes A, B in preferential position there are provided sphere positioning means 21 elastically compressed by a spring against a countershaped seat formed on each axis.

There are provided distancing means constituted by a screw 22 which is screwed in a threaded hole formed in the central part of the plate 13 and having a hexagonal set head 23 and an abutment end 24 supportable at the bone. Other distancing means, for rigidly holding the bone portion in position during drilling, are constituted by Kirschner wires, not shown in the drawings, fixed in the bone and passing through calibrated holes 25 provided in the base plate 13 and calibrated holes 26 provided in the cover 16.

The second clamp 4 is essentially constituted by a second supporting portion 27, in turn formed by a base 28 upon which a cover 30 is hinged at 29. The base and the cover have facing seats 31 for holding drilling guides for the screws insertable in the distal portion of the bone, not shown in the drawings, by means of a locking action provided by a screw with a knob 32.

The base 28 has a protruding appendix 33 with an end pin 34 inserted in an arcuate groove 35 with centre C formed in a transversal circular arc element 36 having on one of its flat faces a graduated scale 37 for measuring the torsion angle of the clamp.

The centre C of the groove 35 should coincide approximately with the axis of the bone when the clamp 4 is mounted on the rod 2 and defines a third correction axis, perpendicular to the first two A, B, of the distal portion of the bone affected by torsion.

For blocking the angular position of the clamp 4, there is provided a screw with knob 38 which is screwed on the appendix 33.

There are provided distancing means constituted by a screw 39 which is screwed in a threaded hole formed in the appendix 28 and having ends adapted to be supported at the distal portion of the bone to be corrected.

At the extremities of the flat element 36 there are formed connection tenons 40, 40' which permit a right or left mounting on the rod 2 according to the requirements. The tenons 40, 40' may be inserted in the groove 6 of the rod 2 and be blocked in position by means of a screw with knob 41 which is screwed in respective threaded holes 42, 43 formed in correspondence with tenons 40, 40'.

In operation, the surgeon obtains with x-rays on multiple planes the angles of the angular defects of the proximal portion and of the torsion defects of the distal

portion, and then imposes and blocks such angles on the clamps 3, 4 and mounts the latter on the rod 2. Thereafter the drilling of the bone in correspondence with the proximal and distal portions is carried out by using the drilling guides blocked on the clamps 3, 4. Then the osteotomy of the bone in correspondence with the proximal and distal portions is carried out and the clamps are brought back in correct position towards the rest position imposed by the preferential positioning means eliminating the angular defects of the bone. Finally, the clamps of the apparatus are substituted with those of an external fixator which sustains the limb for the entire period of growth of the bone callous up to complete recovery.

## Claims

1. Orthopaedic apparatus, particularly for the surgical correction of angular and longitudinal defects of the bones of limbs, of the femur and tibia type, comprising a longitudinal rod (2) externally positionable substantially parallel to a bone for correction, a first clamp (3) movably anchored to said rod for supporting drilling guides for screws insertable in a proximal portion of the bone, and at least one second clamp (4) movably anchored to said rod for supporting drilling guides for screws insertable in a distal portion of the bone, said first and second clamps being orientatable and selectively blockable, before the surgical intervention, in predetermined angular positions with respect to said longitudinal rod corresponding to the angular deformations of the bone, and being repositionable with respect to said rod in correct angular positions after the osteosynthesis of the proximal and distal portions of the bone so as to eliminate the angular deformations of the bone.
2. Orthopaedic apparatus according to claim 1, wherein said first clamp has a supporting portion (12) for said drilling guides united to a first portion (8) for connection to said rod by means of first (A) and second (B) mutually perpendicular hinging axes.
3. Orthopaedic apparatus according to claim 1, wherein said connection portion of said first clamp is anchorable to said rod such that said first and second hinging axes are perpendicular to the longitudinal axis (Y) of the rod.
4. Orthopaedic apparatus according to claim 1, wherein said first clamp (3) has preferential positioning means for maintaining said supporting portion in operative position substantially orthogonal with respect to said rod.
5. Orthopaedic apparatus according to claim 2, wherein said preferential positioning means are of

the sphere (21) type elastically compressed in a centering seat formed on each hinging axis.

6. Orthopaedic apparatus according to claim 5, wherein said supporting portion (12) comprises a base plate (13), a cover (16) hinged on said base (13) and a blocking knob (18) for blocking said cover against said base locking therebetween the drilling guides. 5
7. Orthopaedic apparatus according to claim 6, wherein said first clamp (3) has adjustable distancing means for positioning said supporting portion with respect to the facing bone portion. 10
8. Orthopaedic apparatus according to claim 7, wherein said distancing means comprise a screw (22) screwed in a threaded hole provided in a substantially central position of said base plate. 15
9. Orthopaedic apparatus according to claim 7, wherein said distancing means comprise one or more Kirschner wires insertable in the proximal portion of the bone in calibrated holes (25, 26) formed in said base plate and in said cover. 20 25
10. Orthopaedic apparatus according to claim 1, wherein said second clamp (4) comprises a second supporting portion (27) for the drilling guides connected to a second portion (36) for connecting to said rod by means of circular arcuate guide means (35) with an axis (C) substantially coincident with the axis of the bone to be corrected. 30
11. Orthopaedic apparatus according to claim 10, wherein said circular arcuate guide means (35) extend in a transversal plane when said second connecting portion is anchored to said rod. 35
12. Orthopaedic apparatus according to claim 1, wherein said second supporting portion (27) comprises a base (28) and a cover (30) as well as screw distancing means (39) for maintaining said second claim (4) at a predetermined distance with respect to the distal portion of the bone to be corrected. 40 45
13. Orthopaedic apparatus according to claim 12, wherein said rod (2) has a longitudinal seat (6) with a substantially trapezoidal transverse cross section for slidably holding first (8) and second (40, 40') connecting portions with dovetail shape of said clamps. 50

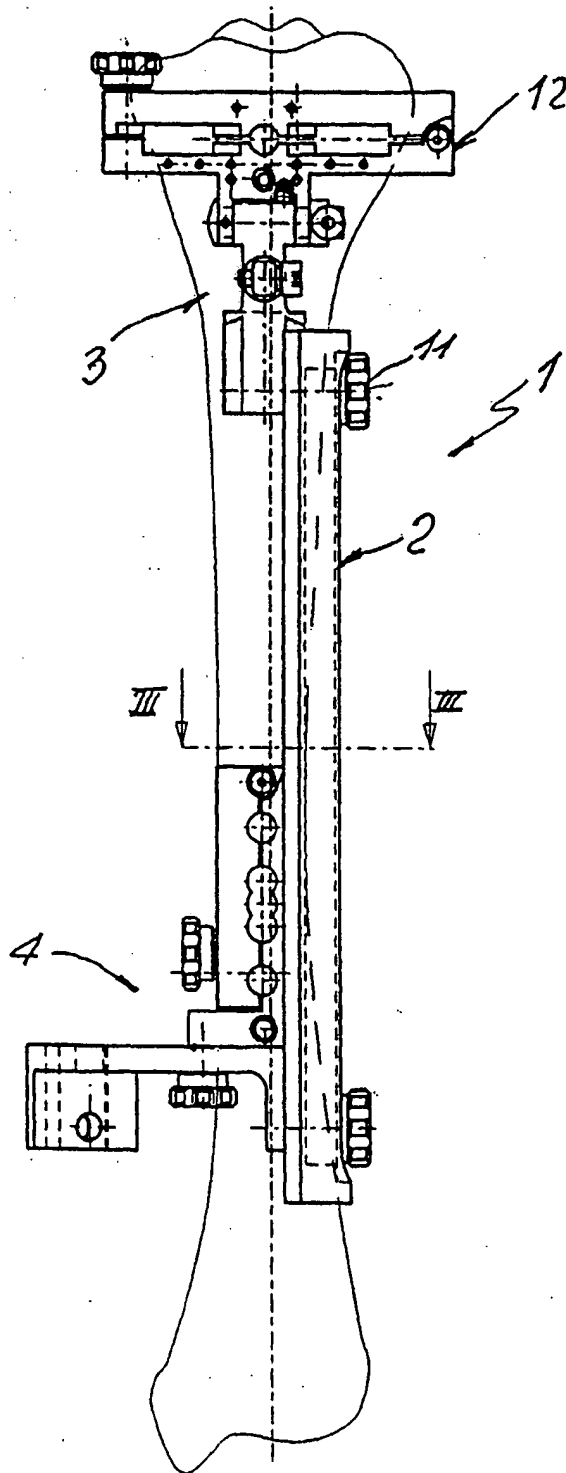


Fig. 1

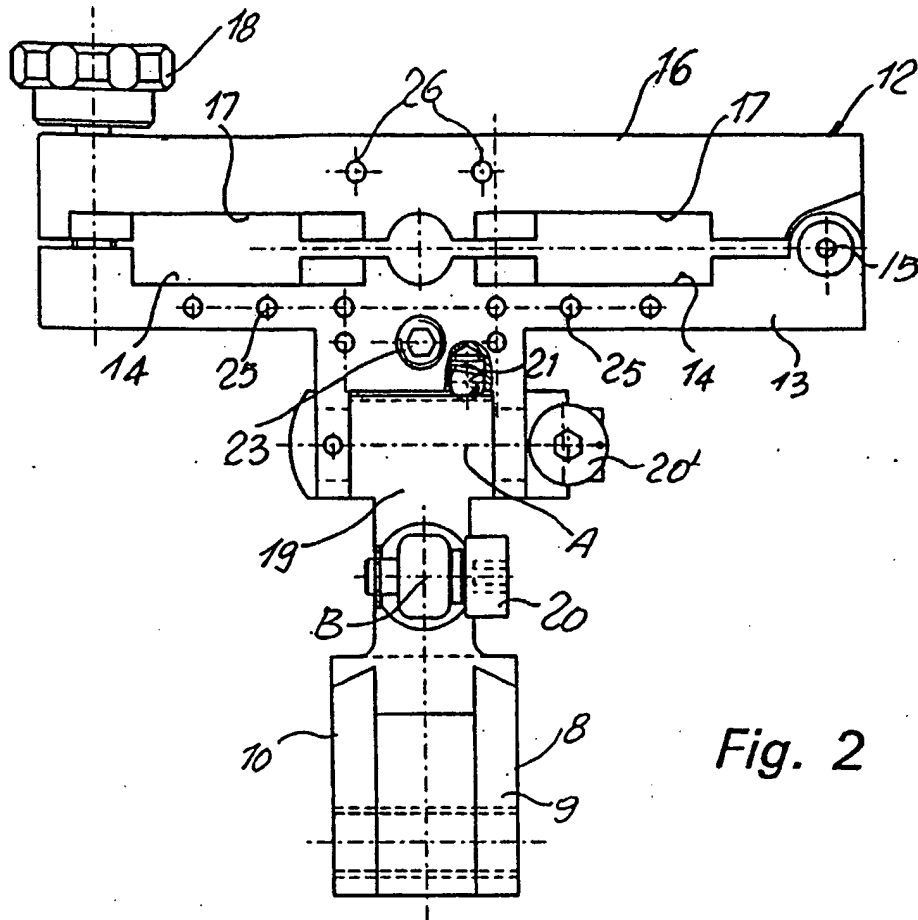


Fig. 2

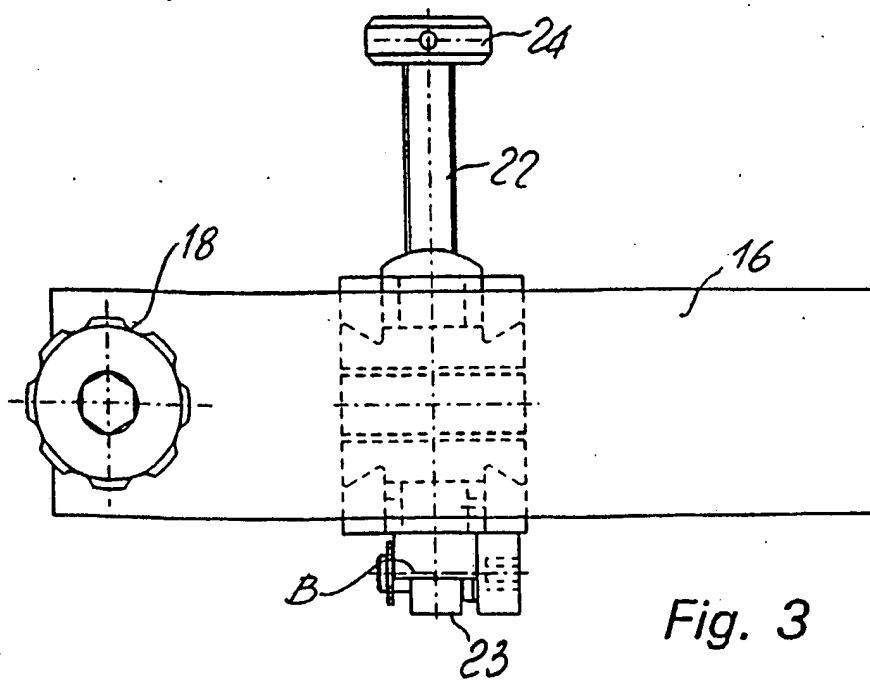
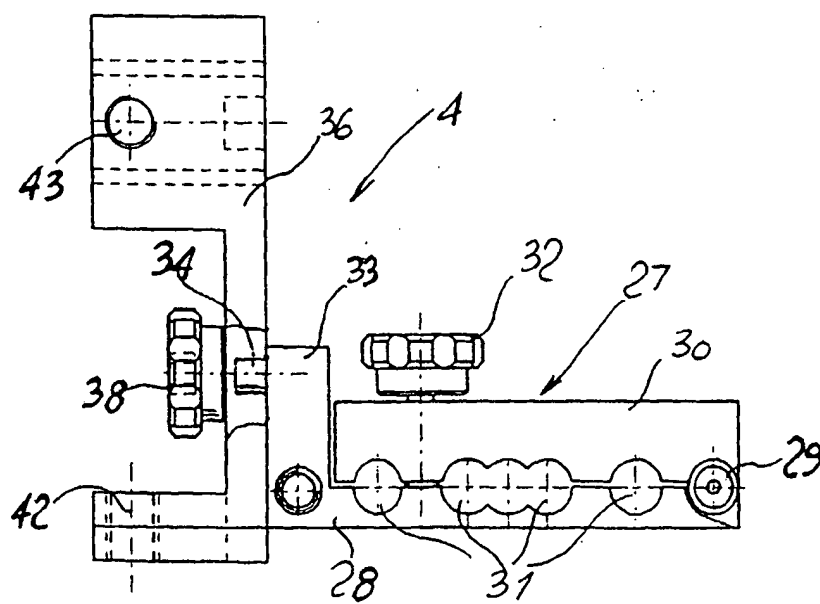
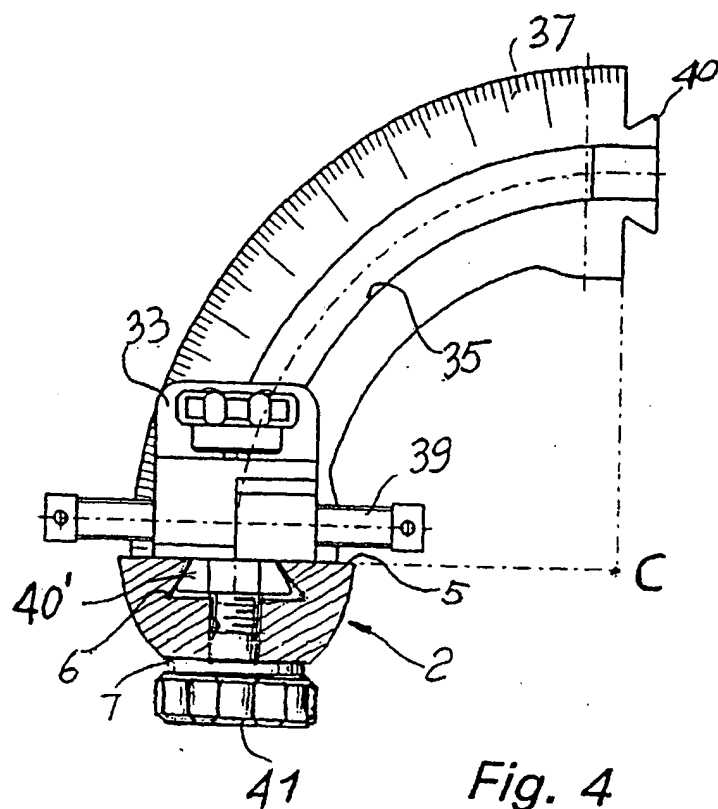
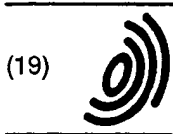


Fig. 3





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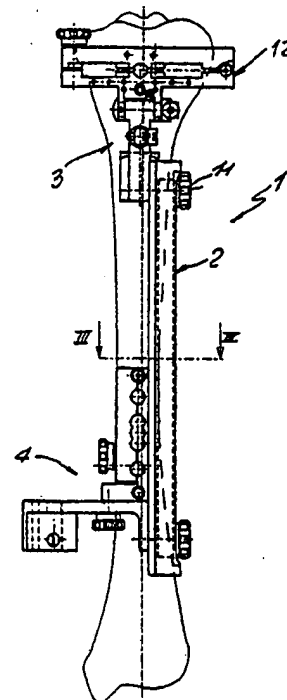


Fig. 1





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Application Number  
EP 97 12 2920

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Place of search BERLIN		Date of completion of the search 17 March 1999	Examiner Hansen, S
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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